

Confirmation No. 6402

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	LANKHORST <i>et al.</i>	Examiner:	Lee, Eugene
Serial No.:	10/599,270	Group Art Unit:	2815
Filed:	September 25, 2006	Docket No.:	NL040358US1 (NXPS.682PA)
Title:	ELECTRIC DEVICE COMPRISING PHASE CHANGE MATERIAL		

RESPONSE TO OFFICE COMMUNICATION

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Dear Sir:

This paper is being submitted in response to the Notification of Non-Compliant Appeal Brief mailed from the U.S.P.T.O. on February 1, 2011. In accordance with M.P.E.P. § 1205.03 and 37 C.F.R. § 41.37(c), Appellant requests entry of the attached claims appendix, which shows the appealed claims as amended in the Final Office Action Response filed June 2, 2010 (as previously entered). The communication indicates that only this section is required to be submitted. No further changes are intended with the filing of this response.

Appellant's Deposit Account No. 50-4019 (NL040358US1) was charged the requisite Appeal Brief fee. While no further charges should be necessary, authorization is given to charge the above account in support of this filing.

Please direct all correspondence to:

Corporate Patent counsel
NXP Intellectual Property & Standards
1109 McKay Drive; Mail Stop SJ41
San Jose, CA 95131

By: 

Robert J. Crawford
Reg. No.: 32,122
651-686-6633
(NXPS.682PA)

APPENDIX OF CLAIMS INVOLVED IN THE APPEAL
(S/N 10/599,270)

1. An electric device having:
a resistor comprising a layer of a phase change material being changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity, the phase change material being a fast growth material, the resistor being switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase.
2. An electric device as claimed in claim 1, further comprising means for switching the resistor between the at least three different electrical resistance values.
3. An electric device as claimed in claim 1, wherein the portion of the layer (7, 107) of phase change material is in direct contact with a further resistor (6, 106) arranged in parallel with the resistor.
4. An electric device as claimed in claim 3, wherein the further resistor has a further electrical resistance which is smaller than the largest of the at least three different electrical resistance values.
5. An electric device as claimed in claim 4, further comprising a read out signal generator for providing an electric read signal having a read voltage (V) to the resistor and a read out circuit for determining the resistance value from the electric read signal, the read out circuit requiring a minimum current (I), the further resistance ($R_{sub.fr}$) being smaller than the read voltage (V) divided by the minimum current (I), ($R_{sub.fr} < V/I$).
6. An electric device as claimed in claim 4, further comprising a read out signal generator for providing an electric read signal having a read current (I) to the resistor and a read out circuit

for determining the resistance value from the electric read signal, the read out circuit requiring a minimum voltage (V), the further resistance ($R_{\text{sub.fr}}$) being smaller than the minimum voltage (V) divided by the read current (I), ($R_{\text{fr}} < V/I$).

7. An electric device as claimed in claim 4, wherein the resistor is switchable between N different electrical resistance values, N being an integer larger than two, the electric device further comprising a read out circuit for determining the resistance value, the read out circuit being able to discriminate between two resistance values having a relative resistance difference larger than or equal to a minimum detectable relative resistance difference $(dR/R)_{\text{min}}$, a ratio ($k = R_{\text{fr}}/R_{\text{cr}}$) of the further resistance (R_{fr}) over a minimum resistance (R_{cr}) of the layer (7, 107) of the phase change material satisfying $k/[(1+k)(N-1)] > (dR/R)_{\text{min}}$.

8. An electric device as claimed in claim 3, wherein the layer of phase change material and the further resistor have a contact resistance of $10^{-7} \text{ V cm}^2/\text{A}$ or less, preferably $10^{-8} \text{ V cm}^2/\text{A}$ or less, preferably $10^{-9} \text{ V cm}^2/\text{A}$ or less.

9. An electric device as claimed in claim 1, wherein the phase change material constitutes a conductive path between a first contact area and a second contact area, a cross section of the conductive path being smaller than the first contact area and the second contact area.

10. An electric device as claimed in claim 5, wherein a part of the conductive path having the said cross section constitutes a volume of phase change material, the volume having an electrical resistance which is larger than an electrical contact resistance at the first contact area and/or at the second contact area, irrespective of whether the phase change material is in the first phase or the second phase.

11. An electric device as claimed in claim 1, wherein the phase change material is a composition of formula $\text{Sb}_{1-c}\text{M}_c$ with c satisfying $0.05 \leq c \leq 0.61$, and M being one or more elements selected from the group of Ge, In, Ag, Ga, Te, Zn and Sn.
12. An electric device as claimed in claim 11, wherein c satisfies $0.05 \leq c \leq 0.5$, and preferably $0.10 \leq c \leq 0.5$.
13. An electric device as claimed in claim 1, wherein the phase change material is substantially free of Te.
14. An electric device as claimed in claim 1, wherein the resistor is comprised in a body, the resistor constitutes a memory element, and the body further comprises:
 - an array of memory cells, each memory cell comprising a respective memory element and a respective selection device, and
 - a grid of selection lines,
 - each memory cell being individually accessible via the respective selection lines connected to the respective selection device.
15. An electric device as claimed in claim 14, wherein:
 - the selection device comprises a metal oxide semiconductor field effect transistor having a source region, a drain region and a gate region, and
 - the grid of selection lines comprises N first selection line, M second selection lines, and an output line,
 - the resistor of each memory element electrically connecting a first region selected from the source region and the drain region of the corresponding metal oxide semiconductor field effect transistor to the output line, a second region of the corresponding metal oxide semiconductor field effect transistor, selected from the source region and the drain region and lying free from the first region, being electrically connected to one of the N first selection lines, the gate region being electrically connected to one of the M second selection lines.

16. The electronic device of claim 1, wherein the fast growth material has a crystal growth mechanism wherein crystalline growth occurs along the interface between an amorphous phase of the material and a crystalline phase of the material, and the phase change material being a composition of the formula $\text{Sb}_{1-c}\text{M}_c$, where $0.05 \leq c \leq 0.61$, and M is from the group of Ge, In, Ag, Ga, Te, Zn, and Sn.

17. An electric device comprising:

a resistor comprising a layer of a phase change material being changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity, the phase change material being a fast growth material characterized by its crystal growth along an interface between an amorphous phase of the material and a crystalline phase of the material, the resistor being switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase.

18. The electronic device of claim 17, wherein the phase change material is a composition of the formula $\text{Sb}_{1-c}\text{M}_c$, where $0.05 \leq c \leq 0.61$, and M is from the group of Ge, In, Ag, Ga, Te, Zn, and Sn.

19. An electric device comprising:

a resistor comprising a layer of a phase change material being changeable between a first phase with a first electrical resistivity and a second phase with a second electrical resistivity different from the first electrical resistivity, the resistor being switchable between at least three different electrical resistance values by changing a corresponding portion of the layer of the phase change material from the first phase to the second phase, and the phase change material being a fast growth material and a composition of one of: the formula $\text{Sb}_{1-c}\text{M}_c$, where $0.05 \leq c \leq 0.61$, and M is from the group of Ge, In, Ag, Ga, Te, Zn, and Sn; a material including Ge, Ga, or Ge and Ga; and a material that is substantially free of Te.

20. The electronic device of claim 19, wherein the fast growth material is a material including at least one of Ge and Ga at a concentration which in total is between 10 atomic percent and 30 atomic percent.

21. The electronic device of claim 19, wherein the fast growth material is a material including at least one of Ge and Ga at a concentration which in total more than 20 atomic percent, and including at least one of In and Sn at a concentration which in total is below 30 atomic percent.